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Sarah B. Lawskey

University of California Irvine School of Law, slawskey@law.uci.edu

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HOW TAX MODELS WORK

SARAH B. LAWSKY*

Abstract: Unlike many social and physical sciences, legal scholarship includes little or no discussion of what models mean, how they are connected to the real world of law and policy, or how they should, and should not, be used by legal scholars. This void exists notwithstanding legal scholarship's increasing reliance on explicit modeling in fields such as law and economics. This Article uses the example of economic modeling in tax scholarship to investigate how legal scholarship uses models, and how models in legal scholarship work. The Article lays out a path between two extremes. At one extreme is scholarship that employs models without either reflection or self-consciousness to make real-world recommendations; at the other is scholarship that rejects models because their assumptions are too far from reality. This Article argues that neither approach is correct. Models are useful and important for legal scholarship, but not in the way that some critics and proponents seem to believe. Drawing from literature in the philosophy of science, this Article argues that we reason from economic models through a mix of deductive and ampliative logic, through leaps, creativity, and intuition. Models cannot provide certainty about what the law should be; rather, economic models are merely one kind of voice in an ongoing and necessarily inconclusive conversation. This Article concludes by drawing on this deeper understanding of models and modeling to propose ways that legal scholarship can and should use economic models.

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Models are at bottom tools for approximate thinking; they serve to transform your intuition. . . . You must start with models and then overlay them with common sense and experience.

—Emanuel Derman & Paul Wilmott¹

INTRODUCTION

Imagine a very simple model of tax compliance: a person complies with the tax law when she believes that the expected value, measured in dollars, of complying is greater than the expected value, measured in dollars, of not complying.² What can we learn from this model about the real world? To answer this question, we need to know *how* this model is meant to tell us about the world. What is the *mechanism by which* we are supposed to learn about the world from a model?

Here is one critique of this simple model: “People take things into account other than just the dollar value of the penalty when they are trying to figure out what will happen to them if they do not comply with the tax law.” Here is another critique: “Your model deals with something called ‘dollars,’ so it does not apply to my situation, because I am trying to figure out tax compliance in Belgium, where the currency is called ‘Euros.’” The first critique seems useful; the second one does not. But why? Unlike many social and physical sciences, including economics, biology, and physics, legal scholarship includes little or no discussion of what models mean, how they are connected to the real world of law and policy, or how models should and should not be used by legal scholars. This void exists notwithstanding legal scholarship’s increasing reliance on explicit modeling, including, for example, work in law and economics and in empirical legal studies. This Article engages scholarship on the philosophy of modeling in order to understand how legal scholarship does and should use models.

This Article lays out a path between two extremes. At one extreme is scholarship that employs models without either reflection or self-consciousness to make real-world recommendations; at the other is scholarship that rejects models because their assumptions are too far from reality. This Article argues that neither approach is correct. Mod-

¹ Emanuel Derman & Paul Wilmott, *The Financial Modelers’ Manifesto*, EMANUEL DERMAN’S BLOG (Jan. 8, 2009, 3:14 PM), <http://www.wilmott.com/blogs/eman/index.cfm/2009/1/8/The-Financial-Modelers-Manifesto>.

² The expected value of an event is, of course, the probability of that event multiplied by the value of the event’s occurring.

els are useful and important for legal scholarship, but not in the way that both critics and proponents believe.

This Article neither attacks nor defends the use of models. It does not argue that law professors should not use economic models, or that law professors necessarily or even usually use economic models incorrectly. Rather, this Article explains a mechanism by which models may work. Specifically, this Article argues that we reason from models to the real world through leaps, creativity, and intuition. Once we understand the way models work, we can understand how to use and critique models more effectively. Economic models cannot provide certainty, but models are nonetheless one important voice in an ongoing, necessarily inconclusive conversation.

This Article has three main parts. The first is descriptive, and explores how tax legal scholarship uses economic models such as the optimal tax model and the expected utility model.³ The second is analytic, and asks what philosophy of science, in particular philosophy of economics, tells us about models, both in general and in legal scholarship. The third is prescriptive, and uses this deeper understanding of models and modeling to describe and propose ways that tax legal scholarship can use models.

Part I defines “model” for purposes of this project, and then provides examples of two economic models and how tax legal scholars have used them.⁴ Part II draws on philosophy of science literature to lay out four possible ways that models could work and concludes that models in legal tax literature are best considered as creating credible worlds from which we may reason ampliatively to the real world.⁵ Part III shows how the credible world understanding of models can improve how legal scholarship uses models.⁶

³ The arrow can go the other way, too. I ask what models can teach us about law, but as Peter Diamond has described, we can also ask what law can teach us about models. Peter Diamond, *My Research Strategy*, in EMINENT ECONOMISTS II: THEIR WORK AND LIFE PHILOSOPHIES (Michael Szenberg & Lall Ramrattan eds.) (forthcoming) (manuscript at 5), available at <http://economics.mit.edu/files/6139> (“I started taking classes at Harvard Law School, planning to write on law and economics, hoping to find some question in that realm that would be a route to what I was really interested in—the importance for resource allocation that trade happens in real time, rather than in the all-at-once way of Arrow-Debreu theory. That is, I was hoping that thinking about a concrete legal problem would lead to modeling that captured a real time process and resulted in insights that would be more generally usable.”).

⁴ See *infra* notes 7–61 and accompanying text.

⁵ See *infra* notes 62–145 and accompanying text.

⁶ See *infra* notes 146–180 and accompanying text.

I. MODELS IN ACTION

This Part defines “model” for purposes of this Article and then provides examples of economic models as used in tax legal scholarship.⁷

A. *What Is a Model?*

This Article focuses on one kind of economic model. For purposes of this Article, a scholar uses an economic model whenever he or she argues deductively from exactly specified economic premises, either implicitly or explicitly.⁸ This Section expands on each element of this definition.

1. Deductive Reasoning

A model, as defined for purposes of this Article, uses deductive reasoning.⁹ The validity of a deductive argument depends on the proper application of logical rules.¹⁰ For example, the following is a valid deductive argument: If we assume that all donkeys are red, and that I am a donkey, then we conclude, logically, that I am red. It does not matter that not all donkeys are red, nor that I am not a donkey; the point is that if both those things were true, then I would be red. The truth (as opposed to the validity) of a deductive argument does, however, depend on the truth of its premises and assumptions. It is not true that I am red, so it must be the case either that not all donkeys are red, or that I am not a donkey. In some sense, deductive reasoning does not increase our knowledge; rather, it “orders and rearranges” it.¹¹ Because models use deductive reasoning, a model’s conclusions come inexorably from applying logical rules to the model’s assumptions.¹² A purely deductive argument can add no facts to those already implicit in the

⁷ See *infra* notes 8–61 and accompanying text.

⁸ Allan Gibbard & Hal R. Varian, *Economic Models*, 75 J. PHIL. 664, 666 (1978). Other kinds of models, including computer simulations and statistical models, raise different, albeit related, issues; this Article does not discuss such models.

⁹ *Id.* at 668.

¹⁰ *Id.* at 670.

¹¹ John Vickers, *The Problem of Induction*, STAN. ENCYCLOPEDIA PHIL. (June 21, 2010), <http://plato.stanford.edu/archives/fall2011/entries/induction-problem/>; see also BRIAN SKYRMS, CHOICE AND CHANCE: AN INTRODUCTION TO INDUCTIVE LOGIC 18 (4th ed. 2000) (stating that in a deductively valid argument, “the factual claim made by the conclusion is already implicit in the premises”).

¹² Gibbard & Varian, *supra* note 8, at 670.

argument's premises.¹³ Deductive reasoning is therefore purely explicative.

Deductive reasoning thus contrasts with ampliative reasoning. Ampliative reasoning, which includes but is not limited to inductive reasoning, goes beyond what an argument logically implies.¹⁴ Fundamentally, what sets ampliative reasoning apart from deductive reasoning is that ampliative reasoning is not compelled—it is not necessary.¹⁵ Rather, ampliative reasoning is contingent. Ampliative reasoning adds something to our knowledge that is not contained by necessity in the premises of the argument.¹⁶ Ampliative reasoning is also famously difficult to justify,¹⁷ but it is nonetheless pervasive, as we shall see. Economic models, as defined for purposes of this Article, use solely deductive logic internally, and thus are explicative, not ampliative, internally.

2. Economic Premises

This Article concerns itself with *economic* models. Because a model, in my definition, is simply a set of assumptions subject to deductive reasoning, the assumptions themselves—their subject and substance—

¹³ This does not mean, of course, that deductive arguments add nothing to knowledge. See *infra* notes 149–156 and accompanying text (discussing further the value of deductive arguments).

¹⁴ Vickers, *supra* note 11. A variety of types of reasoning are ampliative—indeed, any reasoning other than deductive reasoning is ampliative. Ampliative reasoning includes induction, both in the modern and classical sense, as well as abduction. In the modern sense, an argument is “inductively strong” if the argument “is not deductively valid but nevertheless the premises provide good evidence for the conclusion.” SKYRMS, *supra* note 11, at 17. The classical sense of induction, a subset of the modern sense, is reasoning from the part to the whole. *E.g.*, ARISTOTLE, *PRIOR ANALYTICS* 99 (Robin Smith trans., Hackett Publ'g Co. 1989) (350 B.C.E.). Induction can include reasoning from the specific to the general (“I have seen five ducks that are yellow, and I therefore conclude that all ducks are yellow”), or from the specific to a particular prediction (“I have seen five ducks that are yellow, and I therefore conclude that the next duck that I see will be yellow”). Abductive arguments, in contrast to inductive arguments, give weight to whether a conclusion seems to be a good explanation for a hypothesis. An abductive argument “posits . . . a connection between explanatory force and trust.” Igor Douven, *Abduction*, STAN. ENCYCLOPEDIA PHIL. (Mar. 9, 2011), <http://plato.stanford.edu/archives/spr2011/entries/abduction/>.

¹⁵ SKYRMS, *supra* note 11, at 19.

¹⁶ *E.g.*, *id.* (“If an argument is inductively strong, its conclusion makes factual claims that go beyond the factual information given in the premises. . . . [T]he advantage which inductively strong arguments have over deductively valid ones [is] the possibility of discovery and prediction of new facts on the basis of old ones.”).

¹⁷ Vickers, *supra* note 11; see DAVID HUME, *A TREATISE OF HUMAN NATURE* 86–94 (Oxford Univ. Press 2d ed. 1978) (1739–1740) (offering a classic statement of the problem of induction).

must be what makes a model an economic model. Thus we can say that this Article addresses only models that reason from economic premises.

The substantive definition of economics is itself a contested question. The best definition is probably that economics is what economists do. Economics is an academic discipline, and the studies of people in that discipline thus create the answer to the question of what economics is. Economics is what legal scholars find when we look to economic scholars for insight. That said, Lionel Robbins's definition may come closest to what is described in this Article: economic science studies "the forms assumed by human behavior in disposing of scarce means."¹⁸ Judge Richard Posner embraces a similar definition: "economics is the science of rational choice in a world . . . in which resources are limited in relation to human wants."¹⁹ Much broader definitions are possible—the leading economics textbook, for example, adopts nineteenth-century economist Alfred Marshall's definition, that "[e]conomics is a study of mankind in the ordinary business of life."²⁰ At any rate, common neoclassical economic assumptions are familiar, including the main assumption that people are rational decisionmakers who act to maximize their own utility.²¹ This Article discusses only neoclassical models, though its reasoning could apply to other types of economics as well.

3. Implicit and Explicit Models

Quite dissimilar arguments, in form, at least, may be models, or based on models.²² A mathematical model is, of course, a model. Purely mathematical models rarely appear in legal scholarship, however. Rather, legal scholarship tends to use a technical, mathematical model by mentioning it and then casually (as opposed to formally) describing some of its implications; I consider such use to be part of my inquiry here. For example, a scholar uses an economic model when she describes, in words, the "economic model of crime advanced by Gary

¹⁸ LIONEL ROBBINS, AN ESSAY ON THE NATURE AND SIGNIFICANCE OF ECONOMIC SCIENCE 15 (2d ed., rev. & expanded 1945).

¹⁹ RICHARD A. POSNER, ECONOMIC ANALYSIS OF LAW 3 (8th ed. 2011).

²⁰ N. GREGORY MANKIW, PRINCIPLES OF ECONOMICS, at ix (6th ed. 2010).

²¹ See, e.g., *id.* at 6.

²² My use of the term model blurs together Allan Gibbard and Hal Varian's distinction between "models" and "applied models." See Gibbard & Varian, *supra* note 8, at 667.

Becker” and then provides a “simplified example” that is mostly textual, as opposed to numerical.²³

In addition, for purposes of this Article, a statement that implicitly includes economic assumptions, together with the reasoning that follows from that statement and the implicit assumptions, is also a model. Thus, a scholar who refers to the “simple approach to the problem of tax compliance [that] holds that when people decide whether to pay their taxes, they take account only of the cost of the tax and the expected legal sanction from noncompliance” uses an economic model.²⁴

B. *Models in Tax Legal Scholarship*

This Section provides two examples of economic models and how they are used in tax legal scholarship. It first focuses on the optimal tax model, and shows how scholars have used this model as a general guide to policy and law.²⁵ It then examines the expected utility model and shows how scholars have used this model to support direct arguments about a specific policy.²⁶

1. The Optimal Tax Model as a General Guide to Policy and Law

The optimal tax model, first proposed by James Mirrlees, models the best tax rate structure for earned income, where the “best” structure is the structure that maximizes societal welfare.²⁷ Mirrlees’s model balances two concerns: that the next dollar is worth more to a poorer person than to a richer person, and that higher taxes may dissuade people from working.²⁸ This model has been used in legal scholarship primarily as a general guide to policy and law. It has been presented not as the basis of specific, detailed recommendations, but rather to support a general legal approach. Scholarship that uses this model, consistent with how models are often presented in economics literature, usually does not explain how to connect the model to the real

²³ Leandra Lederman, *The Interplay Between Norms and Enforcement in Tax Compliance*, 64 OHIO ST. L.J. 1453, 1463–68 (2003).

²⁴ See, e.g., Eric A. Posner, *Law and Social Norms: The Case of Tax Compliance*, 86 VA. L. REV. 1781, 1783 (2000) (referring to the statement, and a discussion of its implications, as a model).

²⁵ See *infra* notes 27–47 and accompanying text.

²⁶ See *infra* notes 48–61 and accompanying text.

²⁷ See generally J.A. Mirrlees, *An Exploration in the Theory of Optimum Income Taxation*, 38 REV. ECON. STUD. 175 (1971) (developing a model of optimum income taxation).

²⁸ *Id.*

world, whether through law or policy.²⁹ Nonetheless, these articles suggest that their models give us information about the real world.

For example, Joseph Bankman and Thomas Griffith's article *Social Welfare and the Rate Structure: A New Look at Progressive Taxation*, which introduced optimal tax theory to the legal literature, uses the optimal tax model to provide a "normative underpinning" for a progressive rate structure.³⁰ Bankman and Griffith select this model because, they say, it is a "reliable method for assessing the level of social welfare associated with [a] particular rate structure."³¹ By "reliable," the authors seem to mean something like "manageable" or "capable of being implemented," as opposed to "accurate."³² Their article also embraces the optimal tax model because it could be used under "varying assumptions," thus permitting a "search for robust results—that is, results that remain constant over . . . a wide range of assumptions."³³

Bankman and Griffith do not make specific policy proposals, but they do suggest that their model should be taken into account when structuring the tax system.³⁴ Bankman and Griffith's article argues that the optimal tax model recommends a particular tax structure, but that "[t]he merit of [this conclusion] depends . . . on the validity of the optimal tax model."³⁵ By "validity," the authors appear to mean something about the realism of the "simplifying assumptions" underlying the model.³⁶ The article examines four of these assumptions that it states "have particular importance to tax policy,"³⁷ and finds that altering these assumptions leaves the "optimal shape of the tax structure" (that is, progressive) "essentially unchanged."³⁸ To adjust these assumptions, the authors draw from various empirical studies to estimate the "real" values of various factors in the optimal tax model.³⁹

²⁹ See, e.g., Robert Sugden, *Credible Worlds: The Status of Theoretical Models in Economics*, 7 J. ECON. METHODOLOGY 1, 33 (2000) (noting, in a discussion of two prominent models, "on closer inspections of the texts, it is difficult to find any explicit connection being made between the models and the real world").

³⁰ Joseph Bankman & Thomas Griffith, *Social Welfare and the Rate Structure: A New Look at Progressive Taxation*, 75 CALIF. L. REV. 1905, 1907 (1987).

³¹ *Id.* at 1945.

³² See *id.*

³³ *Id.*

³⁴ *Id.* at 1966–67.

³⁵ *Id.* at 1959.

³⁶ See Bankman & Griffith, *supra* note 30, at 1959.

³⁷ *Id.* That is, the authors perform a sort of robustness testing.

³⁸ *Id.*

³⁹ See *id.* at 1921–25.

The authors position the article as an intervention in a theoretical debate, but they also claim that their work should have practical implications: “Although the optimal tax literature does not answer the question of what the exact rate structure should be,” they aver, “it strongly suggests that if a goal of the tax system is to maximize individual welfare, the rate structure should be progressive.”⁴⁰

Similarly, in *The Superiority of an Ideal Consumption Tax over an Ideal Income Tax*, Joseph Bankman and David Weisbach investigate one particular model within the optimal tax framework—that put forth by Anthony Atkinson and Joseph Stiglitz in 1976⁴¹—to shed light on what they view as “the single most important tax policy decision [:] the choice between an income tax and a consumption tax.”⁴² They note that they “compare only the ideal forms of income and consumption taxation. The actual choice of a tax system has to be based on how the system would be implemented.”⁴³ They investigate the ideal forms to “help[] us design actual systems” and to “understand the flaws of actual systems.”⁴⁴

Bankman and Weisbach acknowledge that the model on which they focus “contains assumptions and simplifications,” and they distinguish their work from the issue of the actual design of income or consumption taxes.⁴⁵ Nonetheless, their article is not limited to the theoretical. Much of the article plays out the implications of the model, adding complications, including certain types of irrationality.⁴⁶ Although Bankman and Weisbach repeatedly emphasize that their article addresses only ideal tax systems, they also speculate that “[a] comparison of nonideal systems would likely strengthen [their] conclusion.”⁴⁷ They do not, however, expand on this claim, and they do not suggest that the Atkinson and Stiglitz model leads directly to this conclusion. Their article thus investigates one particular model and its implications in great depth, and suggests some ways in which future work could expand the model or relax its assumptions, but it does not explicitly link the model to real-world proposals.

⁴⁰ *Id.* at 1966–67.

⁴¹ Anthony Atkinson & Joseph Stiglitz, *The Design of Tax Structure: Direct Versus Indirect Taxation*, 6 J. PUB. ECON. 55, 56 (1976).

⁴² Joseph Bankman & David A. Weisbach, *The Superiority of an Ideal Consumption Tax over an Ideal Income Tax*, 58 STAN. L. REV. 1413, 1414 (2006).

⁴³ *Id.* at 1414–15.

⁴⁴ *Id.* at 1415.

⁴⁵ See *id.* at 1430 n.33 (“The design of tax systems is beyond the scope of this Article, which merely considers ideal tax systems.”).

⁴⁶ *Id.* at 1444–48.

⁴⁷ *Id.* at 1455.

2. The Expected Utility Model as a Blueprint for the Law

The expected utility model hinges on the idea that people decide whether to take a tax position by weighing the expected utility of taking the position against the expected utility of not complying, where expected utility is determined by weighting each possible outcome by its probability.⁴⁸ Slightly more technically, the expected utility model imagines a taxpayer who begins with income I . If the taxpayer does not take the position, he will pay tax of T . If he does take the position and the position is not ultimately struck down, he will not have to pay the tax. If the position is struck down, though, he will have to pay the tax and a fine, F , and thus his income will equal $I - T - F$. The chance that the position will be struck down is represented by p . (In this version of the model, p represents a blended probability that takes into account all relevant probabilities, including the chance that the taxpayer will be audited, the chance that if he is audited, his position will be detected, and the chance that if the position is detected, it will be struck down.) Thus, where the taxpayer's utility is represented by $U(\cdot)$, and utility is determined only by income, the expected utility model says that the taxpayer will take a particular position when

$$pU(I - T - F) + (1 - p)U(I) > U(I - T)$$

Perhaps because the expected utility model is so intuitive, some legal scholars have used it as the basis for specific proposals for how law should be changed. Alex Raskolnikov, for example, has used the expected utility model to propose a new type of tax penalty, the "self-adjusting penalty," which increases as the chance of the position's being detected decreases.⁴⁹ The key element of the expected utility model for Raskolnikov is that outcomes are weighted by probabilities.⁵⁰ Thus, he argues, as the probability of detection decreases (which would result in a decrease in p), the magnitude of the penalty (F) should increase.⁵¹

⁴⁸ See, e.g., James Andreoni et al., *Tax Compliance*, 36 J. ECON. LITERATURE 818, 823–24 (1998).

⁴⁹ See generally Alex Raskolnikov, *Crime and Punishment in Taxation: Deceit, Deterrence, and the Self-Adjusting Penalty*, 106 COLUM. L. REV. 569 (2006) (proposing that tax avoidance penalties set forth in the Internal Revenue Code be adjusted to reflect the probability that such tax avoidance will be detected). Raskolnikov actually applies a somewhat simplified version of this model—the expected value model—which compares not the utility of dollars, but rather dollars themselves. This is equivalent to assuming that taxpayers are risk-neutral. See Sarah B. Lawsky, *On the Edge: Declining Marginal Utility and Tax Policy*, 95 MINN. L. REV. 904, 916–17 (2011).

⁵⁰ Raskolnikov, *supra* note 49, at 599.

⁵¹ *Id.*

Raskolnikov acknowledges both the many assumptions underlying economic modeling and other, noneconomic explanations of taxpayers' behavior. He concedes that "even if we posit purely rational taxpayers, we would be unable to derive clear policy prescriptions from the existing economic models."⁵² Nonetheless, he concludes that "economic models offer numerous valuable insights for which we should find . . . practical applications. . . . [W]e should rely on the clear implications of the [expected utility model] to detect and reform" tax law.⁵³ And indeed, Raskolnikov's proposal is extremely detailed. He specifies the types of tax positions to which the penalty should apply (subtraction items only, including deductions, credits, and losses);⁵⁴ he explains how the amount of the penalty should be determined (based on the size of legitimate subtractions of the same type);⁵⁵ and he even suggests how tax returns should be designed to implement the penalty.⁵⁶ He frequently moves between the models and real-life constraints, but sometimes seems to do so reluctantly. For example, he laments that "tax evasion models are simply not designed to analyze" a certain type of deterrence, and thus, because "the theoretical framework needed to reach [this type of deterrence] is largely absent," he will settle for the "third-best alternative of improving (rather than optimizing)" our tax system.⁵⁷

Similarly, Daniel Shaviro uses the expected utility model to argue against fault-based tax penalties.⁵⁸ He writes that

tax evaders are modeled as making risky investments that pay off in the form of reduced taxes unless the evasion is detected, corrected, and penalized. . . . [I]n the simple case of a risk-neutral taxpayer evading \$1 million of taxes with a 20 percent probability of being caught, a penalty of 400 percent . . . would leave both the taxpayer and a risk-neutral government indifferent between evasion and compliance.⁵⁹

He claims that adapting this model "to deal with ex ante legal uncertainty" is "straightforward," and concludes that "treating bad faith as a

⁵² *Id.* at 579.

⁵³ *Id.* at 642.

⁵⁴ *Id.* at 626.

⁵⁵ *Id.* at 601.

⁵⁶ Raskolnikov, *supra* note 49, at 606.

⁵⁷ *Id.* at 612 (emphasis omitted).

⁵⁸ Daniel Shaviro, *Disclosure and Civil Penalty Rules in the U.S. Legal Response to Tax Shelters*, in TAX AND CORPORATE GOVERNANCE 229 (Wolfgang Schön ed., 2008).

⁵⁹ *Id.* at 239.

penalty prerequisite is dubious . . . in theory.”⁶⁰ Shaviro does not draw any conclusions about how penalties should be structured directly from this model; indeed, he acknowledges that this model is “clearly less than perfect in [its] assumptions” and “perhaps best suited to the corporate context.”⁶¹ The bulk of his article investigates the actual law and the institutional effects of fault-based penalties. The model seems to serve as one support for his ultimate conclusion, though, that the U.S. tax system should not have fault-based penalties.

These scholars’ approaches to both the optimal tax model and the expected utility model illustrate reasoning from models to the real world. Part II of this Article explores how these leaps from models to the real world might be justified.

II. FOUR WAYS MODELS MIGHT WORK

As the previous Part describes, tax legal scholarship uses economic models both as general guides to the law and as support for specific legal proposals. But because legal scholarship provides no account of how models should be used, and in particular how models can (or cannot) be linked to the real world, scholarship that uses such models opens itself to the same basic criticisms that have dogged economics for years, including the criticism that their models are too unrealistic. This Part investigates four ways that models may work: as purely conceptual exercises,⁶² as representations of the real world,⁶³ as predictors,⁶⁴ and as credible worlds.⁶⁵ Part III then concludes that models in tax legal scholarship are best understood as representing credible worlds.⁶⁶

A. *Exploration*

It does not matter how models could be applied to the real world to the extent that legal scholarship, like some economic scholarship, is concerned not at all with applying economic models to the real world, but rather merely with studying the models themselves. Such scholarship would use models only for “conceptual exploration,”⁶⁷ to apply “ba-

⁶⁰ *Id.* at 240, 242.

⁶¹ *Id.* at 239.

⁶² See *infra* notes 67–70 and accompanying text.

⁶³ See *infra* notes 71–92 and accompanying text.

⁶⁴ See *infra* notes 93–120 and accompanying text.

⁶⁵ See *infra* notes 121–145 and accompanying text.

⁶⁶ See *infra* notes 146–180 and accompanying text.

⁶⁷ DANIEL M. HAUSMAN, *THE INEXACT AND SEPARATE SCIENCE OF ECONOMICS* 221 (1992).

sic principles to particular problems.”⁶⁸ As philosopher Daniel Hausman explains, some economists

merely construct[] concepts and employ[] mathematics and logic to explore further properties which are implied by the definitions they have offered. Such model building and theorem proving does not presuppose that one believes that the particular model is of any use in understanding the world. . . . Insofar as one is only working with a model, one can dismiss any questions about the realism of the assumptions one makes [because] one is saying *nothing* about the world. . . . [N]o empirical claims have been made. Insofar as one is only working with a model, one’s efforts are purely conceptual or mathematical.⁶⁹

I could find no example of a tax legal scholar who did not try in some way to evaluate how his model matched up with the real world.⁷⁰ This consistent attempt to connect to the real world may, however, not be such a good thing. Of course, one may wonder why legal academics should engage in “purely conceptual or mathematical” reasoning; after all, how can we say we are studying law if we are merely chasing down mathematical questions or playing out logical implications?

There are at least two benefits to conceptual investigation by legal scholars, and one caveat. First, a purely conceptual investigation can suggest areas of future research by serving as one step in a deductive chain that ultimately leads to the leap to the real world. One person might write an article that investigates a particular model conceptually. The next person might add on to that model or critique a particular assumption, perhaps making the model more credible. This may continue until finally somebody takes the leap from the model to our world. Different scholars are good at different things, after all.

⁶⁸ *Id.* at 95.

⁶⁹ *Id.* at 79.

⁷⁰ For example Louis Kaplow cautions that

the sometimes stark results presented . . . are offered as benchmarks for thinking, not as one-size-fits-all prescriptions for policy. The purpose of this book is not to champion particular policies or analytical results but rather to urge a new way of thinking. . . . [I]t is the course of future research that will indicate the value of the theory . . . that is advanced here.

LOUIS KAPLOW, *THE THEORY OF TAXATION AND PUBLIC ECONOMICS* 415–16 (2008). Nonetheless, Kaplow does discuss actual policy issues throughout the book, and he notes where more empirical research would be useful.

Second and relatedly, purely conceptual investigation can suggest areas of future empirical research. Someone might propose a purely conceptual model but decline to link the model to the real world because he does not know whether a particular fact holds true in the real world. He can conclude only that, within his model, given all the other assumptions of the model, "If A, then B," but he has no idea whether A is even close to true in the real world. Someone else, seeing the assumption in the model, might decide to test that assumption empirically—he might, for example, run a laboratory experiment to see whether A seems to be true. Upon finding that A is overwhelmingly supported by his tests, the second person might then decide that it is warranted to link the model to the real world.

All this is subject, however, to an important caveat: if a model is a purely conceptual exercise, it cannot be more than that. The claim that a model is a purely conceptual speculation is not a defense against critiques of that model; rather, a purely speculative model is best seen, like a model that creates a credible world, as part of an ongoing conversation. If a purely speculative model provides deductive links in a chain, then others may make arguments about whether that model presents a credible world and thus warrants extension to the real world. The response to the claim that a model does not present a credible world should not be, "Well, yes, but I meant this model to be purely speculative." A purely speculative model makes no claims about the real world, and thus someone who argues that the model does not extend to the real world does not contradict that model, but simply helps us understand whether we should consider the speculative model when thinking about the real world.

Although legal scholars do not typically use models simply to speculate about the models themselves, they could, and perhaps should, sometimes use models in this way.

B. *Representations of the Real World*

Because legal scholars often intend that their discussion of models connects to the real world, models might seem to be representations of the real world, and thus "good" only if their assumptions are "close enough" to the real world. Critiques of economic models often claim that these models' assumptions are too far from reality, and that the models are therefore not useful. Alex Raskolnikov, for example, argues that because of the "disconnect between tax theory and reality," the

reach of tax law and economics is “relatively limited.”⁷¹ He claims that economic analysis is “dramatically less successful” in tax than in other areas of the law, and that it has “little to offer . . . decisionmakers” because of the many assumptions needed to use economic models to analyze tax systems.⁷²

Indeed, the models discussed in Part I are based on deeply unrealistic assumptions. James Mirrlees, the original creator of the optimal tax model that Joseph Bankman and Thomas Griffith’s article explicates, acknowledged some of the many assumptions on which his model relied.⁷³ Among those assumptions are that all people have the same tastes, and that voluntary transfers are impossible; that individuals determine whether to work based on rational calculations; that people are unable to move out of the United States; that the government has perfect information about everyone in the economy; and that there are no costs to administering the tax system.⁷⁴ Obviously, none of these assumptions is true.

Critiques of Anthony Atkinson and Joseph Stiglitz’s extension of the optimal taxation model, as applied in Joseph Bankman and David Weisbach’s article, have also focused on critiquing the assumptions underlying the model. Daniel Shaviro argues that the model depends on three assumptions, none of which is satisfied. First, the Atkinson-Stiglitz result supports consumption taxation only if one assumes complete markets, that is, markets that “cover every possible commodity and combination thereof.”⁷⁵ Second, the result requires that people are rational and consistent.⁷⁶ People must have the same preferences and make the same choices, regardless of how information is presented to them. They must not, for example, overweight current benefits as compared to future benefits.⁷⁷ Third, the result assumes that a policy-maker receives no information relevant for distributional questions from the time period during which a taxpayer spends money.⁷⁸ Measuring lifetime earnings under the Atkinson-Stiglitz model, for example,

⁷¹ Alex Raskolnikov, *Accepting the Limits of Tax Law and Economics*, 98 CORNELL L. REV. (forthcoming 2013) (manuscript at 5) (on file with author).

⁷² *Id.*

⁷³ Mirrlees, *supra* note 27, at 175–76; see Bankman & Weisbach, *supra* note 30, at 1946–66.

⁷⁴ *Id.*

⁷⁵ Daniel Shaviro, *Beyond the Pro-Consumption Tax Consensus*, 60 STAN. L. REV. 745, 749 (2007).

⁷⁶ *Id.*

⁷⁷ *Id.*

⁷⁸ *Id.* at 749–50.

requires that we do not care, from a distributional perspective, whether a taxpayer spends money as a young person or as an older person.⁷⁹ Shaviro shows that none of these three assumptions are true, which, he says, “refute[s] the claim that an ideal consumption tax is decisively superior to an ideal income tax, as judged from the standpoint, not of a stylized economic model, but of the actual world in which we live.”⁸⁰

Similarly, Chris Sanchirico criticizes Bankman and Weisbach’s article for, among other things, its strong and, he argues, unrealistic assumptions.⁸¹ For example, Sanchirico notes that Bankman and Weisbach’s article envisions a world in which there is only a single taxpayer in each earning class, which is clearly not true.⁸² Sanchirico also critiques Bankman and Weisbach’s assumption that utility is “weakly separable” in leisure—that is, that there is no commodity whose use increases with increased leisure.⁸³

The assumptions and elements of the expected utility model are also much criticized. For example, the expected utility model assumes that people are rational cost-benefit maximizers, which they are not.⁸⁴ It is not possible to measure individuals’ utility.⁸⁵ It is also not possible to measure the probabilities in the expected utility model.⁸⁶ Even if utility and probability can be measured separately, multiplication may not be the right way to combine them.⁸⁷ Utility is, for most people, not simply a function of consumption, or consumption and leisure; it may, for example, also include a taste for fairness, or a preference for (or against) complying with tax law, or any number of other things.⁸⁸ Most versions of the expected utility model do not take into account transaction costs (such as, for example, the cost of defending oneself against

⁷⁹ *Id.* at 749.

⁸⁰ *Id.* at 786.

⁸¹ Chris William Sanchirico, *A Critical Look at the Economic Argument for Taxing Only Labor Income*, 63 TAX L. REV. 867, 903–16 (2010).

⁸² *Id.* at 905.

⁸³ *Id.* at 940.

⁸⁴ See generally Christine Jolls et al., *A Behavioral Approach to Law and Economics*, 50 STAN. L. REV. 1471 (1998) (advancing an approach to the economic analysis of law that acknowledges that people are not rational actors).

⁸⁵ See, e.g., MATTHEW D. ADLER & ERIC A. POSNER, *NEW FOUNDATIONS OF COST-BENEFIT ANALYSIS* 23–24 (2006).

⁸⁶ See generally Sarah B. Lawsky, *Probably? Understanding Tax Law’s Uncertainty*, 157 U. PA. L. REV. 1017 (2009) (arguing that probability statements in tax law are best understood as a reflection of the speaker’s beliefs).

⁸⁷ E.g., Bengt Hansson, *The Appropriateness of the Expected Utility Model*, 9 ERKENNTNIS 175, 177 (1975).

⁸⁸ Sarah B. Lawsky, *Fairly Random: On Compensating Audited Taxpayers*, 41 CONN. L. REV. 161, 189–91 (2008).

the Internal Revenue Service).⁸⁹ The expected utility model cannot take into account that the probability that a position will be struck down is unknown, and that some, perhaps most, individuals are not uncertainty-neutral.⁹⁰ It is not possible to make interpersonal comparisons of utility.⁹¹ Even a single individual does not have a single utility function; rather, a person's utility function may change over time, especially if that person's income changes over time.⁹² And this is only a partial list of ways that the expected utility model is not realistic.

Both the optimal tax model and the expected utility model are thus based on profoundly, even absurdly, incorrect and simplified assumptions. If these models are meant to be no more than smaller, manageable, but still somewhat realistic representations of the real world, then they fail miserably.

C. Predictors

1. The Idea

Perhaps we should not be concerned that the assumptions underlying these models are unrealistic. All models are simplified.⁹³ "The map is *not* the territory,"⁹⁴ nor would a map that corresponded directly to the world be of much use.⁹⁵ More specifically, Milton Friedman fa-

⁸⁹ *Id.* at 169.

⁹⁰ See generally Sarah B. Lawsky, *Unknown Probabilities and the Tax Law*, 65 STAN. L. REV. (forthcoming 2013) (presenting a model of tax compliance that takes into account taxpayer attitudes toward uncertainty).

⁹¹ See generally Daniel M. Hausman, *The Impossibility of Interpersonal Utility Comparisons*, 104 MIND 473 (1995) (arguing that it is impossible to make comparisons of utility among individuals); ROBBINS, *supra* note 18, at 12–13. But see, e.g., ADLER & POSNER, *supra* note 85, at 40–52 (proposing a method for interpersonal comparisons).

⁹² Harry Markowitz, *The Utility of Wealth*, 60 J. POL. ECON. 151, 152 (1952).

⁹³ E.g., Uskali Mäki, *Realistic Realism About Unrealistic Models*, in THE OXFORD HANDBOOK OF PHILOSOPHY OF ECONOMICS 68, 70–71 (Harold Kincaid & Don Ross eds., 2009) ("Economic models involve idealizations just like the most respectable physical theories do: just think of the idealizations of frictionless plane, perfectly elastic gas molecule, rigid body, planets as mass points, two-body solar system. . . . It became clear that falsehood in assumptions will not be sufficient grounds for [e.g., Milton Friedman's] antirealist instrumentalism about economic theory."); *id.* at 72 ("Much of the criticism of economics is . . . based on the mistaken belief that criticism is easy—such as when inferring from unrealistic assumptions to models being incorrect.").

⁹⁴ Alfred Korzybski, *A Non-Aristotelian System and Its Necessity for Rigour in Mathematics and Physics*, in SCIENCE AND SANITY: AN INTRODUCTION TO NON-ARISTOTELIAN SYSTEMS AND GENERAL SEMANTICS 747, 750 (5th ed. 1994).

⁹⁵ See, e.g., JORGE LUIS BORGES, *On Exactitude in Science*, in COLLECTED FICTIONS 325 (Andrew Hurlley trans., 1999); LEWIS CARROLL, SYLVIE AND BRUNO CONCLUDED 169 (London, MacMillan & Co. 1893) ("We actually made a map of the country, on the scale of a

mously responded to the objection that economic models' assumptions are so wrong as to render these models useless by arguing that the test of a model is not whether its assumptions are realistic, but rather how well the model predicts the future.⁹⁶ "Complete 'realism' is clearly unattainable," he acknowledged, but "the question whether a theory is realistic 'enough' can be settled only by seeing whether it yields predictions that are good enough for the purpose in hand or that are better than predictions from alternative theories."⁹⁷

Indeed, Friedman argued that the more unrealistic the assumptions, the better the theory: "A hypothesis is important if it 'explains' much by little . . . if it abstracts the common and crucial elements from the mass of complex and detailed circumstances . . . and permits valid predictions on the basis of them alone."⁹⁸ Friedman suggested that theories take an "as if" approach: it does not matter whether the assumptions are realistic, but whether the world behaves *as if* the assumptions are realistic.⁹⁹ For example, it is surely not true that leaves on a tree seek to maximize the amount of sunlight they receive, but the leaves are positioned as if that were true, and thus "leaves on a tree seek to maximize the amount of sunlight they receive" may be a useful theory for some circumstances. Criticizing a theory for unrealistic assumptions is, Friedman argued, "largely beside the point"; the only question is whether changing an assumption improves the accuracy of the theory's predictions.¹⁰⁰ Theorists should be concerned with "analytic relevance," not "descriptive accuracy."¹⁰¹

Friedman's essay has been highly influential in law and economics scholarship. Judge Richard Posner, one of the founders of the law and economics movement, has embraced Friedman's position. In a 1975 article citing Friedman's essay, now-Judge Posner wrote, "[T]he econ-

mile to the mile! . . . It has never been spread out, yet . . . the farmers objected: they said it would cover the whole country, and shut out the sunlight! So we now use the country itself, as its own map, and I assure it does nearly as well."), *quoted in* JOAN ROBINSON, *ESSAYS IN THE THEORY OF ECONOMIC GROWTH* 33 (1963); TISH RABE, *THERE'S A MAP ON MY LAP!* 12 (2002) ("Now, if maps were the size / of the places they show, / mapmakers would run / out of paper, and so . . ."); ROBINSON, *supra*, at 33 ("A model which took account of all the variegation of reality would be of no more use than a map at the scale of one to one.").

⁹⁶ MILTON FRIEDMAN, *The Methodology of Positive Economics*, in *ESSAYS IN POSITIVE ECONOMICS* 3 (1953). This is not the only important claim in Friedman's essay, but it is the most important one for purposes of this Article.

⁹⁷ *Id.* at 41.

⁹⁸ *Id.* at 14.

⁹⁹ *Id.* at 41.

¹⁰⁰ *Id.* at 31.

¹⁰¹ *Id.* at 41.

omist is not interested in the question whether and in what sense people may be said to be ‘rational.’ It is enough for purposes of economic analysis that the assumption of rationality has greater explanatory power than alternative assumptions.”¹⁰² Although Judge Posner does not cite Friedman explicitly, he takes a similar, though somewhat more nuanced, approach in the 2011 edition of his casebook *Economic Analysis of Law*.

[L]ack of realism in the sense of descriptive completeness, far from invalidating the theory, is a precondition of theory. . . . [W]e need not try to evaluate [a model’s] assumptions directly in order to evaluate it. Judged by the test of explanatory power, economic theory is a significant . . . success. . . . Another (and stronger—why?) test of a scientific theory is its predictive power.¹⁰³

Friedman’s essay has also been cited many times in legal scholarship for the proposition that in economics, the best test of a model is its predictive power.¹⁰⁴

Following Friedman’s essay, then, one might argue that we should not care about whether the assumptions in the expected utility model are unrealistic. We should care only whether the model accurately pre-

¹⁰² Richard A. Posner, *The Economic Approach to Law*, 53 TEX. L. REV. 757, 763 n.25 (1975).

¹⁰³ POSNER, *supra* note 19, at 21. One oddity of a casebook is that the parenthetical “why?” can stand as a teaching moment, and tends to suggest that the casebook’s author, and perhaps the student’s professor as well, know the answer.

¹⁰⁴ Jeanne L. Schroeder, *Just So Stories: Posnerian Methodology*, 22 CARDOZO L. REV. 351, 355 n.17 (2001) (providing numerous examples of this claim in legal scholarship, and noting that this is also Judge Posner’s approach). The citations have continued apace since Jeanne Schroeder’s piece was published. See, e.g., Robert J. Condlin, *Legal Bargaining Theory’s New “Prospecting” Agenda*, 10 PEPP. DISP. RESOL. L.J. 215, 246 & n.128 (2010) (citing Friedman’s essay to support the proposition that “[l]ike economics, Prospect Theory may have useful prescriptive advice to give to legal bargainers even if the advice is grounded in an inaccurate empirical understanding of legal bargaining”); Fleur Johns, *Financing as Governance*, 31 OXFORD J. LEGAL STUD. 391, 405 & n.53 (2011) (citing Friedman’s essay to support the proposition that “[t]he recurrent inaccuracy of key assumptions on which models are built for the financing of urban infrastructure is not generally regarded as a sign of weakness in the models themselves, nor as cause to question the basic logic of financial modelling. This is because modelling practice always already contemplates the unreality of the assumptions on which it is founded.”); René Reich-Graefe, *Deconstructing Corporate Governance: Director Primacy Without Principle?*, 16 FORDHAM J. CORP. & FIN. L. 465, 469 n.12 (2011) (citing Friedman’s essay to support the proposition that “[p]redictive ability and accuracy is, of course, the main criterion by which positive (descriptive) economic models are evaluated”).

dicts behavior. This was in fact Friedman's argument for using expected utility theory:

An objection to [expected utility theory] . . . is that it conflicts with the way human beings actually behave and choose. . . . [T]his objection is not strictly relevant. The hypothesis does not assert that individuals explicitly or consciously calculate and compare expected utilities. . . . The hypothesis asserts rather that . . . individuals behave *as if* they calculated and compared expected utility and *as if* they knew the odds.¹⁰⁵

On this understanding of models, the purpose of a model is to predict—not to describe, and not to help us understand a phenomenon. Moreover, we cannot answer in the abstract whether the model is accurate enough. We must know what question we are trying to answer, and whether the predictions are accurate enough for that particular question, in that particular context.¹⁰⁶

2. Beyond Prediction

Within economics, however, Friedman's approach, though influential,¹⁰⁷ is far from uncontroversial. As early as 1963, Paul Samuelson objected to what he dubbed the "Friedman Twist," or the "F-Twist," the idea that "[a] theory is vindicable if (some of) its consequences are empirically valid to a useful degree of approximation; the (empirical) unrealism of the theory 'itself,' or its 'assumptions,' is quite irrelevant to its validity and worth."¹⁰⁸ Samuelson insisted that although "unrealistic, abstract" models could be useful, this does not mean that they are empirically valid. "If the abstract models contain empirical falsities," Samuelson argued, "we must jettison the models, not gloss over their inadequacies."¹⁰⁹

The economics literature contains many other critiques. For example, as Hausman explains, Friedman fails if he means to present an argument, rather than a mere pronouncement.¹¹⁰ According to Haus-

¹⁰⁵ Milton Friedman & L.J. Savage, *The Utility Analysis of Choices Involving Risk*, 56 J. POL. ECON. 279, 297–98 (1948).

¹⁰⁶ See *id.* at 298.

¹⁰⁷ See, e.g., Thomas Mayer, *The Influence of Friedman's Methodological Essay*, in THE METHODOLOGY OF POSITIVE ECONOMICS: REFLECTIONS ON THE MILTON FRIEDMAN LEGACY 119 (Uskali Mäki ed., 2009).

¹⁰⁸ Paul A. Samuelson et al., *Discussion*, 53 AM. ECON. REV. 227, 232 (1963).

¹⁰⁹ *Id.* at 236.

¹¹⁰ HAUSMAN, *supra* note 67, at 162–69.

man, Friedman first asserts that “[a] good hypothesis provides valid and meaningful predictions.”¹¹¹ But this premise does not imply, as Friedman suggests, that “[t]he *only* test of whether an hypothesis is a good hypothesis is whether it provides valid and meaningful predictions,” thus rendering anything else about the hypothesis, including the truth of its assumptions, irrelevant.¹¹² As Hausman points out, Friedman’s argument is in form the same as asserting that “[a] good used car drives reliably,” leaping from there to claiming that the only test of a good used car is whether it drives reliably, and concluding that anything one might learn about the car from looking under the hood is irrelevant.¹¹³ Just as a single road test does not predict a car’s entire future performance, so we cannot know in advance how a theory will perform in new circumstances.¹¹⁴

The problem with Friedman’s approach is perhaps even more acute within legal scholarship if one believes that legal scholarship’s purposes could include more than policy prescriptions.¹¹⁵ I focus here on two problems for legal scholarship of Friedman’s goal of prediction.

First, although some legal scholarship may be intently policy-focused, concerned only with what immediate changes to make to the real world, other scholarship is less immediately connected with direct legal change. Some scholars hope only to advance understanding of some aspect of the law, or to create a platform from which more practical scholars may build. To adopt Friedman’s goal of prediction, and only prediction, is to say that economic models cannot help further our understanding or play a role in more abstract reasoning. If, for example, one’s only goal is to predict on which side of a tree we will find more leaves, then Friedman’s model—that “leaves on a tree seek to maximize the amount of sunlight they receive”—might be sufficient.¹¹⁶ But as Jeanne Schroeder points out, it would be an odd biologist indeed who “would be satisfied, as Friedman is, with the statement that trees look ‘as if’ their leaves moved in such a way.”¹¹⁷ “Rather, [Schroeder] would expect botanists to be interested in learning precisely what

¹¹¹ *Id.* at 166.

¹¹² *Id.* (emphasis added).

¹¹³ *Id.*

¹¹⁴ *Id.*

¹¹⁵ See, e.g., Schroeder, *supra* note 104, at 355–93 (critiquing Friedman’s essay and its reception and use by legal academics).

¹¹⁶ See FRIEDMAN, *supra* note 96, at 19–20.

¹¹⁷ Schroeder, *supra* note 104, at 392.

process causes leaves to become so clustered.”¹¹⁸ Similarly, if models are to help legal scholars who actually want to understand the process by which, for example, a taxpayer chooses whether to comply with the tax law, then models must do more than just predict.

Moreover, it is impossible to check whether some of the models on which legal scholarship relies make correct predictions. We might be able to check whether the expected utility model accurately predicts tax compliance.¹¹⁹ But it is more difficult to check the predictions of the optimal taxation model, which attempts to describe a tax system that maximizes welfare. The optimal tax model is highly unlikely to be implemented anywhere, and even if it were implemented, it would be extremely difficult—if not simply impossible—to determine whether it maximized welfare.¹²⁰ Thus, even if we accept Friedman’s approach of testing models by how well they predict, we cannot implement it because we cannot test many of the models we use.

If we accept these critiques, is anything left of the models used by tax legal scholars? How can such unrealistic models, some of whose predictions cannot even be checked, be useful? I next present an approach to understanding and using models drawn from recent work in the philosophy of science in general, and the philosophy of economics in particular, that suggests that models are more than just lesser, flawed representations of the real world, and that even a very unrealistic model can be useful, even if not for Friedman’s reasons.

¹¹⁸ *Id.* Cf. Anna Alexandrova, *When Analytic Narratives Explain*, 3 J. PHIL. HIST. 1, 9 (2009) (explaining that scholars who attempt to integrate formal models and narrative explanations reject Friedman’s approach because, for “the historically-minded social scientists who advocate [this approach,] . . . explanation requires identification of *causal mechanisms* responsible for bringing about a phenomenon, not just its correct prediction”).

¹¹⁹ Most people who have examined the question think that the expected utility does not predict compliance well. *See, e.g.*, Michael J. Graetz & Louis L. Wilde, *The Economics of Tax Compliance: Facts and Fantasy*, 38 NAT’L TAX J. 355, 358 (1985). One recent article, however, argues that in fact the expected utility model does not do a bad job of explaining compliance, even excluding compliance due to withholding and information reporting. *See* Timothy Shapiro, *The Myth of Tax Morale?* (May 27, 2011) (unpublished paper) (on file with author).

¹²⁰ *Cf.* Mark Blaug, *Ugly Currents in Modern Economics*, in *FACT AND FICTION IN ECONOMICS* 35, 49–50 (Uskali Mäki ed., 2002) (noting that some theories, such as the general equilibrium theory, are “untestable even in principle”).

D. *Credible Worlds*

Models as currently used in legal scholarship are probably best considered to construct parallel, fictional, but “credible worlds.”¹²¹ From this perspective, models are “hypothetical constructions that nevertheless may give us some understanding of the real world.”¹²² We can reason within the model deductively, moving through an argument purely logically, but deductive logic does not provide a way to jump from the model to the real world.

Robert Sugden is the most prominent recent proponent of this fictionalist understanding, which he calls the “credible worlds” approach.¹²³ Sugden uses Thomas Schelling’s “checkerboard city” model to explain this understanding of models. This Section first describes the checkerboard city model, and then extracts principles for credible worlds from Sugden’s work.

Schelling created his checkerboard city model to show that segregation in housing could arise not only from a conscious desire to live in a starkly segregated area, but also from individuals’ desire not to live in a neighborhood in which the overwhelming majority of people are of a different group.¹²⁴ Schelling asks us to mark out a grid of squares “at least the size of a checkerboard” and to distribute coins across the grid, some pennies and some dimes, leaving some empty spaces.¹²⁵ Then we set a rule—for example, that a coin is “content” (stays where it is) if at least half of his neighbors (defined as the eight squares immediately around him) are the same as he. (Schelling refers to a coin as “he” or “him,” not “it.”) Whenever we find a coin that is not content, we move him to the nearest empty square where he is content.¹²⁶ Of course, moving one coin may make another coin not content. We must keep moving coins until none are discontented. For many numbers of dimes and

¹²¹ See generally Robert Sugden, *Credible Worlds, Capacities and Mechanisms*, 70 ERKENNTNIS 3 (2009) (examining how theoretical models can aid in the understanding of real-world phenomena); Sugden, *supra* note 29 (arguing that theoretical models can create credible worlds that tell us something about the real world).

¹²² Tarja Knuuttila, *Isolating Representations Versus Credible Constructions? Economic Modeling in Theory and Practice*, 70 ERKENNTNIS 59, 67 (2009).

¹²³ Sugden, *supra* note 29, at 23–27. Sugden’s forerunners include, among others, Hans Vaihinger. See HANS VAHINGER, *THE PHILOSOPHY OF “AS IF”* (C.K. Ogden trans., 1924).

¹²⁴ THOMAS C. SCHELLING, *MICROMOTIVES AND MACROBEHAVIOR* 147–55 (1978).

¹²⁵ *Id.* at 147.

¹²⁶ *Id.* at 148.

pennies, many initial distributions, and many rules for contentness, the coins will end up sharply segregated.¹²⁷

This model is clever, provocative, easy to understand, and seems to tell us something about how segregated neighborhoods arise.¹²⁸ Schelling seems to think that it should: “The first impact of a display like this on a reader may be—unless he finds it irrelevant—discouragement. A moderate urge to avoid small-minority status may cause a nearly integrated pattern to unravel, and highly segregated neighborhoods to form.”¹²⁹

Schelling may exempt the reader who finds his model irrelevant precisely because it is not clear *why* we should find it relevant.¹³⁰ How do we get information about segregated neighborhoods in the real world from the checkerboard city model? The model’s assumptions are unrealistic in the extreme. People are not all identical except for one characteristic.¹³¹ People do not live in tiny squares, and most people do not even live in housing organized in rectangular grids.¹³² Most people do not make decisions about moving based only on the precise percentage of their neighbors who belong to a particular group. Even if they did, neither the percentage, nor what constituted a “neighbor,” would be the same for all people. A person who moves does not choose where to move by finding the closest house with an acceptable number of neighbors who belong to a particular group. Even more basically: people are not dimes or pennies. And so forth. Yet we are asked, somehow, to make a jump from the model world of coins on paper to the real world.

To make this leap, we must reason ampliatively.¹³³ The checkerboard city model thus creates an argument about the world in two steps: a deductive step and then an ampliative step. First, the model

¹²⁷ You can try it yourself at any number of websites. See, e.g., Luis R. Izquierdo et al., SCHELLING’S MODEL OF SPATIAL SEGREGATION, <http://luis.izqui.org/models/schelling/index.html> (last visited Oct. 10, 2012). Interestingly, although Schelling’s model does serve to illustrate Sugden’s theory, Schelling’s model has much in common with a simulation, which arguably raises a separate set of questions. Thanks to Ben Alarie for this point.

¹²⁸ See Sugden, *supra* note 29, at 24 (stating that Schelling created “a set of *imaginary* cities, whose workings we can easily understand”).

¹²⁹ SCHELLING, *supra* note 124, at 154.

¹³⁰ Schelling does not tell us why we might or might not find it irrelevant, but he seems to think that some readers, at least, will not find it irrelevant. See *id.*

¹³¹ Sugden, *supra* note 29, at 17.

¹³² *Id.*

¹³³ Sugden says that we make this leap by reasoning inductively, by moving “from specific propositions to more general ones.” *Id.* at 20. It is not clear to me that the move is, in fact, inductive, but it is certainly ampliative, and induction is a type of ampliative reasoning.

shows through deductive reasoning that repeatedly applying a single rule about the location of coins leads to separation of the two types of coins. Then, ampliatively, we move from this specific example to the more general case of the real world.

We should not make this jump for every model, of course. We can make the jump from the model to the real world only if the model is similar in relevant ways to the real world. Sugden claims that we make leaps from a model to the real world when the model creates a *credible world*.¹³⁴

Sugden suggests three criteria to evaluate when a model creates a more (or less) credible world. First, credible worlds have rules that are relevantly similar to the real world.¹³⁵ Second, credible worlds show us results that are consistent with what we believe about the real world.¹³⁶ Third, credible worlds are internally coherent.¹³⁷

First, a model creates a credible world when it is similar in relevant ways to the real world. For example, the checkerboard city model assumes that people have mild segregationist preferences, which fits with sociological evidence, intuition, and experience. We would be less compelled by the model if it assumed that people have strong preferences for integration, showed that this leads to integrated neighborhoods, and concluded that neighborhoods are segregated because of intentional government central planning. The assumption that people have strong preferences for integration would have a strong effect on the outcome of the model and would not fit with what we know of the real world.

Similarly, we would be unpersuaded by a tax model that assumed that a person's overall utility (not marginal utility—overall utility) decreases for each dollar a person earns past, say, \$100,000. This assumption would not fit with what most people believe about the world. Thus we would not be persuaded by the model's conclusion that to maximize welfare, the marginal tax rate above \$100,000 should be 100%. Again, the assumption that people's utility decreases in this way has a strong effect on the recommended marginal rate, and would not fit with what we know about the world.

Second, credible worlds show us results that are similar to what we see in the real world. In the checkerboard city model's imaginary "cities," stark segregation between unlike groups (dimes and pennies)

¹³⁴ *Id.* at 23–27.

¹³⁵ *Id.* at 25.

¹³⁶ *Id.* at 26.

¹³⁷ Sugden, *supra* note 29, at 26.

emerges even when imagined discriminatory preferences are mild. When we look at real cities, we also see segregation between unlike groups (in the real world, racial groups). “Since the same effects are found in both real and imaginary cities,” Sugden explains, “it is at least credible to suppose that the same causes are responsible. Thus, we have been given some reason to think that segregation in real cities is caused by preferences for segregation, and that the extent of segregation is invariant to changes in the strength of those preferences.”¹³⁸ The world of “checkerboard city” is not real, but it could be real, based on what we think we know about the laws governing the real world.

Third, models in economics are more credible if they are internally coherent: a credible world’s assumptions should fit naturally together. Sugden gives the example of a model that assumes, apparently without justification, that in some contexts agents are well-informed and rational, and in other contexts are poorly informed and act based on heuristics.¹³⁹ Sugden finds such models unconvincing, because their “results cannot be seen to follow naturally from a clear conception of how the world might be.”¹⁴⁰ We can get a sense of what Sugden means by internal coherence by thinking about a fantasy or science fiction movie.¹⁴¹ A science fiction movie can be more or less credible, depending in part on whether it is true to the rules it establishes within itself. As one example of internal incoherence, in *Star Wars: Episode II*¹⁴² (actually the fifth *Star Wars* movie released), the droid R2-D2 can fly, but in *Star Wars: Episodes IV* through *VI* (the first through third *Star Wars* movies released), he cannot fly. Thus the movies are not consistent with themselves. We can make up an explanation for R2-D2’s inability to fly in the “later” episodes, of course. (In this case, the canonical answer seems to be that his jets came with only a twenty-year warranty.)¹⁴³ But this sort of ad hoc solution is not particularly satisfying, just as ad hoc exceptions to assumptions in models are unsatisfying.¹⁴⁴

¹³⁸ *Id.* at 24.

¹³⁹ *Id.* at 26.

¹⁴⁰ *Id.*

¹⁴¹ Sugden uses the example of a novel. *See id.* at 23–24.

¹⁴² *STAR WARS: EPISODE II—ATTACK OF THE CLONES* (Lucasfilm 2002).

¹⁴³ *See Answers to Your Star Wars Questions*, *STAR WARS INSIDER*, Sept. 2002, at 96, 96; *IA Caps Droid Rocket Warranty at 20 Years*, *HOLONET NEWS*, http://www.holonetnews.com/55/business/1359_2.html (last visited Oct. 10, 2012).

¹⁴⁴ *Cf.* W. Bradley Wendel, *Explanation in Legal Scholarship: The Inferential Structure of Doctrinal Legal Analysis*, 96 *CORNELL L. REV.* 1035, 1070 (2011). W. Bradley Wendel has applied the philosophy of science idea of “inference to the best explanation” to understand certain types of doctrinal scholarship. *Id.* (“[A] good theory . . . conveys a sense that order has been create[d] out of apparent chaos. There is an inevitable aesthetic dimension to evalu-

Sugden's criteria for credible worlds are impressionistic; there is no deductive, foolproof way to know whether a model is the same in relevant ways to the real world (what ways are relevant?), or whether a model's assumptions fit "naturally" together. Some find this uncertainty disquieting.¹⁴⁵ But this is exactly the point. The leap between a model and the real world cannot be filled with certainty, and we are justified in making the leap if the model seems believable enough to us.

That a model "seems believable" cannot, of course, be the end of the matter. As the next Part explains, the conversation that arises when a modeler is asked to justify his leap can itself be of great value.

III. SHAPING CONVERSATION: CREDIBLE WORLDS AND LEGAL SCHOLARSHIP

This Part uses the credible world understanding to show how models can be used in legal scholarship. Section A describes how a model can be useful by creating the structure for conversations.¹⁴⁶ Section B focuses on possible objections to the leap from a model to the real world and possible responses to those objections.¹⁴⁷ Finally, Section C suggests some ways that models' creators can make their models more accessible and useful to legal scholarship.¹⁴⁸

A. *Learning from Deductive Reasoning*

A model, as I have defined it for this Article, uses only deductive reasoning internally. Thus a model cannot provide any new facts about the world.¹⁴⁹ That logical propositions are tautological, however, does not mean that a deductive argument can add nothing to knowledge, for there can, of course, be conclusions implicit in a set of premises that are not (yet) known, and which can be laid bare by a deductive

ating a legal explanation. . . . [Less successful] attempts at unification [of disparate legal outcomes] feel ad hoc or strained.").

¹⁴⁵ See, e.g., Eckhart Arnold, *Tools or Toys?* 19 (SRC SimTech, Stuttgart Preprint Series, No. 2010-36, 2010), available at http://www.eckhartarnold.de/papers/2010_MS4/tools_or_toys.pdf ("[Sugden's approach] raises more questions than it answers: In what sense can a world that is 'counterfactual' still be credible? And what are the criteria by which the credibility of a 'counterfactual' model must be judged?").

¹⁴⁶ See *infra* notes 149–156 and accompanying text.

¹⁴⁷ See *infra* notes 157–177 and accompanying text.

¹⁴⁸ See *infra* notes 178–180 and accompanying text.

¹⁴⁹ E.g., LUDWIG WITTGENSTEIN, *TRACTATUS LOGICO-PHILOSOPHICUS* 155 (1922) ("The propositions of logic are tautologies.").

argument.¹⁵⁰ A model that creates a credible world thus may help us adjust or clarify our thinking. It may “support conjectures,”¹⁵¹ even “elicit new beliefs,” as it brings into focus “vague and rather unspecified intuitions.”¹⁵²

For example, the optimal tax model begins with a set of fairly common, unsurprising assumptions; even if these assumptions are not true in the real world, they are standard assumptions for economic models. James Mirrlees uses only deductive reasoning to travel from these assumptions to his conclusion that, given these assumptions, the best redistributive progressive tax system involves, among other things, low marginal tax rates for high earners.¹⁵³ Mirrlees reaches his results through deductive reasoning, so the results are in some sense implicit in his assumptions. But Mirrlees’ results are nonetheless surprising—indeed, they were surprising to Mirrlees himself: “I must confess,” he writes, “that I had expected the rigorous analysis of income-taxation in the utilitarian manner to provide an argument for high tax rates. It has not done so.”¹⁵⁴

Thus, although Mirrlees’ model does not (as Mirrlees is very careful to say) teach directly about the real world,¹⁵⁵ it still teaches us something new: that a set of admittedly unrealistic but nonetheless common economic assumptions implies that tax rates on high earners should be low. This conclusion shapes all subsequent conversations about structuring a progressive tax system. One cannot say that one supports high marginal rates on high earners simply because one supports a progressive tax system, because Mirrlees has shown that given some combination of assumptions, the best progressive tax system has low marginal rates on high earners.¹⁵⁶ Now there must be an affirmative argument for high marginal rates for high earners, and that argument must respond to Mirrlees’ model. Mirrlees’ model has, in other words, helped

¹⁵⁰ E.g., Catarina Dutilh Novaes, *Surprises in Logic*, in LOGICA YEARBOOK 2009, at 47, 51–52 (Michal Pelis ed., 2010) (“[T]o be a tautology is a *factual* (albeit necessary) property of propositions, whereas the phenomenon of surprises concerns the *recognition* by an agent that some object *a* has property *P*.”).

¹⁵¹ Sugden, *supra* note 121, at 7.

¹⁵² Till Grüne-Yanoff, *Learning from Minimal Economic Models*, 70 ERKENNTNIS 81, 94 (2009).

¹⁵³ Mirrlees, *supra* note 27, at 207.

¹⁵⁴ *Id.*

¹⁵⁵ E.g., *id.* at 207–08 (explaining why he would “hesitate to apply” various of his conclusions to the real world).

¹⁵⁶ See *id.* at 207. Thanks to David Hasen for this point.

shape the conversation about progressive rate structure. The next Section explains how that conversation might proceed.

B. *Learning from Ampliative Reasoning*

Models may do their most important work by not working. Models contribute to the legal conversation not only by creating credible worlds, but also by provoking people to explain why a given model's world is not credible. This Section lays out possible objections to models and shows how responding to those objections can make richer everyone's understanding of the question at hand.

There are two types of critiques of a model. First, a model's deductive reasoning may be wrong. Second, a model may not present a credible world—that is, the ampliative leap between the model and the real world may not be warranted.

Whether a model's deductive reasoning is wrong is a question of logic. Either the model is wrong or it is not. Thus, this critique is the least interesting (though arguably most powerful) form of critique. There is only one possible response to a showing that one's model fails as a matter of deductive logic: "I'm sorry, let me fix that." Unsurprisingly, it is difficult to find an example of this sort of critique in print, as these mistakes are usually caught before publication. Here is one (made-up) example: Imagine a person working with the expected utility model, in which a person complies with the tax law when the expected utility of complying exceeds the expected utility of not complying. Assume that utility is defined (as it often is) as the natural log of income. It is simply wrong to say that the utility of one's income, less the utility of the tax paid, equals the utility of one's income less tax paid.¹⁵⁷

A model whose deductive reasoning is correct nevertheless may be subject to critiques—specifically, critiques that attempt to cast doubt on the validity of the leap between the model and the real world. There are at least three ways to critique such a model's credibility.

First, the substance of an assumption may be wrong. To take a silly example, return to our friend from the Introduction who says, "Your model deals with something called 'dollars,' so it doesn't apply to my situation, because I am trying to figure out about tax compliance in Belgium, where the currency is called 'Euros.'" This person is arguing

¹⁵⁷ That is, $U(I) - U(T)$ is not equal to $U(I - T)$, because $\ln(I) - \ln(T)$ is not equal to $\ln(I - T)$. $\ln(I) - \ln(T) = \ln(I/T)$. This is a fact about logarithms. If someone wrote an article in which he set $U(*)$ equal to $\ln(*)$ and then claimed that $U(I) - U(T)$ equaled $U(I - T)$, he would be wrong.

that something in the model does not match up with something in (the relevant portion of) the real world, and that therefore the model cannot apply to his real world.

Second, the model may simplify a fact about the world. For example, many law review articles that apply the expected utility model described above assume that people have declining marginal utility.¹⁵⁸ In reality, people do not seem to have stable utility functions, and even if they did, those utility functions would not all demonstrate declining marginal utility.¹⁵⁹

Third, and closely related to the second critique, the model may omit a fact about the world. Again returning to the expected utility model, one might object that people do not take into account only the money they will have after they comply or do not comply with the tax law, but also have feelings about what it means to comply or not comply—perhaps they feel like chumps for complying, or perhaps they believe that it is their duty to comply with the tax law, even if it does not seem to make financial sense to them. The difference between simplifying a fact and omitting a fact is more a matter of degree rather than kind, as simplifying a fact is usually the result of omitting another fact. Nonetheless, it is helpful to keep the two as separate categories, to keep track of when a critique introduces a mostly new concept (for example, an individual valuing something other than money) as opposed to making more complicated a concept that already exists within the model (for example, the shape of an individual's utility function).

The latter two critiques (and perhaps the first as well) are always true of all models. All models make simplifying assumptions, and all models omit facts about the world. To show that these critiques are relevant, the critic must go further and show that because of the critique, the model does not create a credible world, and that therefore we should not make the ampliative leap from the model to the real world.

A modeler who wishes to defend his model has at least four possible responses to these critiques: disagree with the substance of the critique; stand by the assumption as a moral claim; refuse to modify the assumption because the change makes the model unworkable; or, most closely related to the credible worlds understanding, claim that changing the assumption does not affect the outcome.

¹⁵⁸ See Thomas D. Griffith, *Progressive Taxation and Happiness*, 45 B.C. L. REV. 1363, 1363 (2004); see also Bankman & Griffith, *supra* note 30, at 1947 (discussing the “declining marginal utility” assumption).

¹⁵⁹ See Jolls et al., *supra* note 84, at 1477.

First, the modeler may disagree with the critique. No, the modeler may say, the substance of my assumption is not wrong. No, I have not simplified a fact about the world: all people have declining marginal utility. No, I have not omitted a fact about the world: people do not take anything into account other than money. These are empirical claims, and require evidence about the world to support them.

Second, the modeler may accept the critique, but respond that as a moral matter, the assumption should be true, and therefore he will act as if it is true. The assumption is, in other words, a normative judgment. For example, a model may include the assumption that all individuals have declining marginal utility, and it may include this assumption not because all individuals do have declining marginal utility, but rather because the modeler believes that we should treat people as if the next dollar is worth less to a rich person than to a poor person.¹⁶⁰ If the model's recommendations depend on this assumption, this admission makes the model useful only to the extent one agrees with the normative judgment.

Third, the modeler may respond that changing the assumption in question would make the model unworkable. Acknowledging that people have wildly different utility functions, for example, might make it too difficult to implement the optimal tax model.¹⁶¹ This is not a particularly useful response, as it does nothing to assuage concerns about the credibility of the world the model creates.

Finally, the modeler may accept the critique, but argue that making the suggested change would not affect the results of the model, either in general or for the modeler's particular purposes. For example, the objection that the currency is named "Euros," not "dollars," is not a relevant objection. The name of the currency does not affect the model. The currency could be called "Noodles"; it could be called anything. (This is not to say that the location of the taxpayers does not matter—simply that the name of the currency involved is not, in itself, important.) In other words, the model does not match up to the real world, but that does not matter, because even if the model did match up to the real world, the model's results would be exactly the same. To put this in the language of credible worlds: the critic is arguing that the model's world is not credible because it varies in a particular way from

¹⁶⁰ See generally Lawskey, *supra* note 49 (examining the assumption that an additional dollar is worth more to a poor person than it is to a wealthy person).

¹⁶¹ It is actually possible to model somewhat heterogeneous preferences. See generally Mikhail Golosov et al., *Preference Heterogeneity and Optimal Capital Income Taxation* (NBER Working Paper 16619, 2010) (examining preference heterogeneity with two types of taxpayer).

the real world; the modeler responds that the world cannot lack credibility for that reason, because within the model's world, that particular fact is irrelevant. This might be related to why science fiction can seem so relevant to our world: superficial differences do not necessarily affect deep underlying similarities. Some people thought the movie *Avatar* was racist;¹⁶² others, including the film's maker, argued that it was not;¹⁶³ but it would have been a weak defense indeed to claim that the film was not racist because it was about blue people, and people in the real world are not blue.

To see examples of these objections and responses in action, and how the debate around a model can itself enhance understanding of important questions, turn again to the debate surrounding Joseph Bankman and David Weisbach's article *The Superiority of an Ideal Consumption Tax over an Ideal Income Tax*.¹⁶⁴ This article presents a credible world and suggests that we should link that credible world to the real world. The article claims to "compare only the ideal forms of income and consumption taxation. The actual choice of a tax system has to be based on how the system would be implemented."¹⁶⁵ Although Bankman and Weisbach limit themselves to comparing the ideal forms of taxation, their claims address which of these systems would be best in the real world. They do not limit themselves to purely conceptual exploration. Thus, they claim that their article should "help[] us design actual systems" and to "understand the flaws of actual systems."¹⁶⁶

In response, Daniel Shaviro cautioned against applying the model to the real world, because, he explained, changing the assumptions under which Bankman and Weisbach operated by making those assumptions more coherent with the real world may also change the recommendation of the model: "Departures from the assumptions . . . have . . . effects on the otherwise compelling welfare economics case for consumption taxation. . . . [T]hey introduce enough noise to make any definite conclusion about the ideal system less tenable than it would otherwise be."¹⁶⁷

¹⁶² See, e.g., Annalee Newitz, *When Will White People Stop Making Movies Like Avatar?*, io9.COM (Dec. 18, 2009, 1:58 PM), <http://io9.com/5422666/when-will-white-people-stop-making-movies-like-avatar>.

¹⁶³ See Gary Susman, *Is 'Avatar' Racist?*, MOVIEFONE (Jan. 11, 2010, 6:15 PM) <http://blog.moviefone.com/2010/01/11/is-avatar-racist/>.

¹⁶⁴ See generally Bankman & Weisbach, *supra* note 42 (comparing an income tax and a consumption tax).

¹⁶⁵ *Id.* at 1414–15.

¹⁶⁶ *Id.* at 1415.

¹⁶⁷ Shaviro, *supra* note 58, at 786.

For example, Bankman and Weisbach's model is based in part on an assumption that consumption can be smoothed over time, by borrowing.¹⁶⁸ Shaviro argues that this assumption does not cohere with the real world (probably in the sense that it oversimplifies), because credit markets are not perfect, and that if credit markets are not perfect, the results of the model do not hold.¹⁶⁹ Shaviro concludes that his investigation of the assumptions underlying the model "refute[s] the claim that an ideal consumption tax is decisively superior to an ideal income tax, as judged from the standpoint, not of a stylized economic model, but of the actual world in which we live."¹⁷⁰ This is not a critique of the model internally, but rather a suggestion that the leap to the real world is not warranted.

Bankman and Weisbach have several responses.¹⁷¹ First, they argue that in fact, credit markets are very good.¹⁷² They reject the criticism as wrong as a matter of fact, and argue that Shaviro's criticism does not actually show a way that the model does not cohere with the real world. Second, they argue that their model's conclusions are not disrupted even if credit markets are not perfect, because imperfect credit markets may not actually support an income tax.¹⁷³ This is a version of saying that the critique is irrelevant—yes, we made this assumption in our model, but the assumption does not actually do much work.

More generally, Bankman and Weisbach agree that "more complex models of behavior are likely to weaken the strong conclusions one gets from simple models," and that "additional research into administering consumption taxes should be given a high priority."¹⁷⁴ In other words, they acknowledge that one should be cautious about making the leap from their relatively simple model to the real world. Importantly, though, Shaviro's response highlighted particular crucial assumptions and provoked Bankman and Weisbach to consider these assumptions more carefully.

Linda Sugin's work provides another example of how modeling can serve as the basis for a conversation that helps our understanding

¹⁶⁸ Bankman & Weisbach, *supra* note 42, at 1435.

¹⁶⁹ Shaviro, *supra* note 58, at 770–72.

¹⁷⁰ *Id.* at 786.

¹⁷¹ Joseph Bankman & David Weisbach, *Reply: Consumption Taxation Is Still Superior to Income Taxation*, 60 STAN. L. REV. 789, 795–802 (2007).

¹⁷² *Id.* at 796.

¹⁷³ *Id.*

¹⁷⁴ *Id.* at 790.

of the law.¹⁷⁵ The optimal tax model prescribes a tax on ability to earn (an endowment tax), but Sugin shows that the model prescribes this result only if one accepts assumptions that do not cohere with the real world. In particular, she argues that the optimal tax model assumes that leisure (time spent not working in the market economy) is not productive, is “self-regarding,” and is voluntary,¹⁷⁶ and that the endowment tax recommendation is derived in part from these assumptions. Changing the assumptions changes the result. She argues that leaps from the optimal tax model and the real world are not warranted because the optimal tax model makes certain assumptions about the nature of leisure that are not realistic and crucially affect the model’s prescriptions.¹⁷⁷

Again, the model has done important work, but not merely by showing that, if one accepts the model, an endowment tax is the best tax. Rather, the model’s work continues when Sugin dissects its assumptions and shows both why they are wrong, or too simple, and how these wrong or simple assumptions affect the model’s recommendation. The model suggests to the careful reader particular points to think about and critique; if the endowment tax seems wrong to you, you can refute the model’s result, but only by making explicit how the model’s assumptions are wrong and why this matters.

C. *Creating Useful Models*

With the understanding that models warrant conclusions about the real world to the extent that the models create credible worlds from which people may reason to the real world, legal scholars who create and work with models can take several steps to make their models more useful to legal scholars.¹⁷⁸

¹⁷⁵ See generally Linda Sugin, *A Philosophical Objection to the Optimal Tax Model*, 64 TAX L. REV. 229 (2011) (challenging certain assumptions underlying the optimal tax model).

¹⁷⁶ *Id.* at 245.

¹⁷⁷ *Id.* at 245–56.

¹⁷⁸ The question of how models should be used by policymakers is a distinct question. The philosopher Anna Alexandrova takes the view that the credible worlds approach does not provide enough guidance to create actual policy. Anna Alexandrova & Robert Northcott, *Progress in Economics: Lessons from the Spectrum Auctions*, in THE OXFORD HANDBOOK OF PHILOSOPHY OF ECONOMICS, *supra* note 93, at 306, 309–10. She uses a different philosophical approach to certain causal models, viewing them as open formulae. See, e.g., Anna Alexandrova, *Making Models Count*, 75 PHIL. SCI. 383, 396–400 (2008). With this as her philosophical basis, she has written a wonderfully rich account of how auction models were applied to create actual FCC spectrum auctions. Alexandrova & Northcott, *supra*, at 309–10. Additionally, Peter Diamond and Emmanuel Saez offer an example in the economics literature of mindful application of a model to the real world. See Peter Diamond & Emmanuel Saez, *The Case for a Progressive Tax: from Basic Research to Policy Recommendations*, 25 J. ECON. PERSPS. 165, 166

First, a reader will have a better sense of how to use an article's model if the article explicitly describes its goal. A legal scholar might want to use a model to advance scholarship about that model, to disagree with another scholar's article, to make a recommendation about the real world, or something else.¹⁷⁹ A model's worth should be measured not by how true it is in the abstract, but by *what it can do*. And to know what it can do, we must know what it is asked to do. We cannot know how good a model is unless we know what we are trying to use it for. Put another way, the question, "Does this model create a credible world?" provides little insight. We must ask, "Does this model create a credible world for purpose X?"

A model is also more useful if the author makes explicit why the model creates a credible world, and how the model connects to the real world. Legal scholarship, like economic scholarship, often fails to tie its models to the real world, leaving implicit precisely what the reader is to make of the model. Because legal scholarship so often does make a policy recommendation, a reader of an article published in a legal journal that presents implications of a model but does not address how the model relates to the real world may take the article as having implications for the real world. Legal scholars who use models should make clear whether they intend to make prescriptions for the real world, and if so, why those prescriptions stem in some way from the model, by explaining why and how the model's conclusions can be linked to the real world.

Finally, and perhaps most importantly, a model is more useful if the author is explicit about the assumptions and limitations inherent to the model. This is especially important in legal scholarship, as not all readers will know that, for example, using an expected value (rather than an expected utility) model implies that all actors are risk-neutral.¹⁸⁰ A model may transform someone's intuition, but it should not do so by hiding its dissimilarities from the real world. Explicitly acknowledging a mod-

(2011). Diamond and Saez take a highly practical, non-philosophical approach to the question, but their standards for applying a model to the world are similar to those discussed here.

¹⁷⁹ E.g., Uskali Mäki, *MISSing the World: Models as Isolations and Credible Surrogate Systems*, 70 ERKENNTNIS 29, 33 (2009) ("The pragmatic context shapes the respects and degrees of resemblance that are sought and judged relevant in any given act of modelling. . . . The purposes of representation may be epistemic—such as answering some limited explanatory questions or isolating an important mechanism—or non-epistemic—such as solving some practical problem and aiding in policy making. . . . [M]odels may be used for communicating, delivering information, persuading, impressing, excluding . . . and educating.").

¹⁸⁰ Lawsky, *supra* note 49, at 916–17.

el's assumptions and limitations may seem to weaken a law review article, but a scholar who is open about a model's assumptions and limitations makes the model more resilient and useful by making possible a scholarly exchange about which assumptions matter and why.

CONCLUSION

This Article has suggested that models work in legal scholarship by describing credible worlds from which we can extrapolate to our actual world. We make this leap not through deduction or logic, but rather through amplification and similarity.

Law and legal studies appear, as any law student learns very quickly, disturbingly indeterminate. Why was this case decided this way and not the other way? Was the judge right or wrong? If that case is heard by this court, how will the court decide? How can this case come out this way, and that case the other way? The answers often feel ad hoc.

The formal models of law and economics, on the other hand, seem to bring rigorous logic to the enterprise. As one professor has explained his conversion to law and economics:¹⁸¹ "I was teaching regulated industries from the typical casebook which simply disclosed what the . . . law was. It simply didn't make any sense to me. I was very much in the market . . . for some theoretical coherence."¹⁸² Law and economics seemed to provide that theoretical coherence. The scientific program for which law professors have yearned at least since Christopher Columbus Langdell appeared to have arrived: "economics is the science of rational choice," and that "science" can be applied to law.¹⁸³ I suspect that one great appeal of models, and of law and economics in general, is that they seem to provide a way to arrive at irrefutable, necessary results.¹⁸⁴ Finally, it seems, law can work purely and deductively; finally, there are clear right and wrong answers. Law and economics seems to bring relief from common law's relentless indeterminacy.

¹⁸¹ I use the word "conversion" advisedly. See generally STEVEN M. TELES, *THE RISE OF THE CONSERVATIVE LEGAL MOVEMENT* (2008) (discussing religious imagery in the growth of law and economics).

¹⁸² Warren Schwartz, *quoted in* TELES, *supra* note 181, at 106. See generally JEROME FRANK, *LAW AND THE MODERN MIND* (Transaction Publishers 2009) (1930) (discussing the discomfort caused by law's indeterminacy), *explained in* Charles L. Barzun, *Jerome Frank and the Modern Mind*, 58 *BUFF. L. REV.* 1127, 1128 (2010).

¹⁸³ POSNER, *supra* note 102, at 3.

¹⁸⁴ I do not suggest that this fully explains why law and economics and modeling has been so successful within the legal academy; that is a much more complicated question. See TELES, *supra* note 181, at 90–134, 181–219 (offering a sociological perspective).

But, as this Article argues, the models of law and economics do not authorize irrefutable deductive reasoning about the real world. Reasoning from models to the real world amplifies, relies on similarity, and is creative and imaginative. Certainty is not one of the many benefits that formal models offer. This does not make modeling useless; far from it. Models can force us toward precision, show us ways to refine our ideas, and, perhaps most importantly, help shape the conversations and arguments by which legal understanding moves forward.

